BIONOMICS OF A CRITICALLY ENDANGERED AND ENDEMIC CATFISH, *HORABAGRUS NIGRICOLLARIS* FROM ITS TYPE LOCALITY IN KERALA[1]

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Data on some aspects of the bionomics of the Bagrid Catfish *Horabagrus nigricollaris* are presented. The Imperial White-collared Catfish is confined to the regime reaches of its type locality – the Chalakudy river, Kerala and is listed as critically endangered. The present sample consists of specimens with a total length ranging from 70-187 mm and total weight ranging from 3.7-66.95 g. The growth was found to be allometric and the regression equation of combined sexes was log W= -1.839+2.855 log 'L'. *H. nigricollaris* is a benthophagic omnivore fish, feeding on insects, algae, and crustaceans. The absolute fecundity of a ripe specimen having a total length of 156 mm and weight 33.70 g was 1,320 eggs with a relative fecundity and GSI value of 413 eggs/g body weight and 9.5 respectively. The male:female sex ratio was 1:1.1. The information generated from this study is the first of its kind on the knowledge of the biology of this endemic catfish.

Key words: *Horabagrus nigricollaris*, endemic catfish, food and feeding habits, reproductive biology, length-weight relationship.

INTRODUCTION

Horabagrus nigricollaris (Pethiyagoda and Kottelat 1994) known as 'Manja koori' locally is confined to the type locality; Vettilapara (10° 17' N, 76° 32' E) in Chalakudy river, Kerala and is listed as Critically Endangered (CAMP Report 1998). It is a bottom inhabitant of the regime reaches of the stream with rocky and sandy/gravelly bed, well adapted to the cold, and free flowing waters of the river. The species is relished and generally consumed by the locals. The study made so far on this species is only on the description and taxonomic aspects by Pethiyagoda and Kottelat (1994), and Shaji and Easa (2003). Studies on biological aspects of the species are lacking therefore, some aspects of the biology such as length-weight relationship, food and feeding and reproductive biology are reported here.

MATERIAL AND METHODS

Fish samples for the present study were collected from the type locality, Vettilapara in Chalakudy river in Kerala from January, 2005 to December, 2005. A total of 48 specimens were collected from the local fishermen that were caught by diverse gears such as cast nets, gill nets, and hook and line. Being a nocturnal fish, fishing was carried out at night. In the rocky pools, hook and line and in the shallow region of regime reach the cast nets were used. Cast nets were hauled by walking through the stream a 100 m stretch throughout the sampling period. For hook and line, prawns caught from the same habitat were used as bait. Throughout the sampling period the catch/unit effort of the species was found to be very low, when compared to other species in the area. Usually the fishing time/duration was 2100 hrs – 0400 hrs at night. Specimens having a total length between 7.0 and 18.7 cm, and weight 3.7 to 66.95 g were examined during the study. Immediately after collection, the specimens were preserved in 10% formalin. The data of the length-weight relationship were analyzed following Le Cren (1961) by the formula, $W=aL^n$. The constants '*a*' and '*n*' in the equation were estimated using the method of least squares. The linear equation was fitted separately for males, females, indeterminate and the combined class. After taking the morphometric measurements such as total length, standard length, and total weight, the guts were dissected. The length, weight and volume of the gut were recorded and the contents taken out for food and feeding analysis. The gut contents were analyzed using Point's method described by Hynes (1950) and Pillai (1952). The index of preponderance was worked out following Natarajan and Jhingran (1961). Ovaries were removed from fresh specimens and their length and weight were recorded. They were then preserved in 10% formalin for ova diameter measurements and fecundity estimation. Excessive formalin was removed from preserved ovaries by washing with distilled water, when sufficiently hard the ovaries were weighed to the nearest milligram.

RESULTS

Length-weight relationship

Table 1 shows the corresponding statistics such as sample size (n), the length-weight ranges (minimum &

maximum), estimated parameters of length-weight relationships (*a*, *n*) and the standard error (SE) and r. Overall, parameters *n* ranged from a minimum of 2.657 for males to maximum of 2.934 for females. Fish samples were included throughout the sampling period, but the data are not representative of a particular season, consequently the parameters '*a*' and '*n*' should be treated as mean annual values. The length-weight relationship of the pooled data has been represented as Fig. 1.

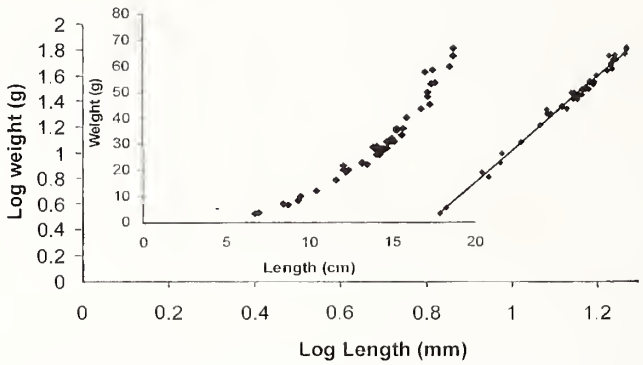

Fig. 1: Length-weight relationship of *Horabagrus nigricollaris*

Food and Feeding Habits

The alimentary canal of *H. nigricollaris* consists of the mouth, buccal cavity with a number of patches of teeth, well-developed stomach, moderately long intestine and rectum. The mouth is sub-terminal in position. The stomach contents include insects, algal remains, semi-digested animal and plant matter, fish molluscs and crustaceans. Insects could be identified from general exoskeletal characteristics. Larvae and nymphs were identified by the characteristic features of different groups. Only generic identification was possible. The insects mainly consisted of the adult, larvae and nymphs of Plectoptera (Stonefly larvae), Ephemeroptera (Mayfly larvae), Hemiptera (Notonecta), Dipterans and Coleoptera (beetles & water penny).The crustaceans consisted of prawns (*Palaemon* spp.) and appendages of crabs (*Barytelphusa* spp.). Molluscs were constituted by snails of the Family Viviparidae. Bits of leaves, fruits and tender shoots of aquatic plants, dried twigs and leaves of other plants that are occasionally washed off in the river waters and the decaying organic matter constituted the plant matter and detritus. The teleosts could be readily identified by the skeletal remains. Their specific identification often becomes difficult due to their being in advanced stages of digestion in the stomach. Besides the above food items, the presence of sand grains, mud and small pebbles in large quantities were noted. Ripe specimens examined during breeding season had almost empty guts. Index of preponderance worked out for *H. nigricollaris* is shown in Fig. 2.

Reproductive Biology

Each testis had numerous thin-walled lobules. During the breeding season the lobules became greatly distended with spermatids and spermatozoa. The ovaries are paired, rounded, elongated organs, which on attainment of full maturity, occupy nearly the entire body cavity. The two lobes of the ovaries gradually taper down towards the posterior extremity where they unite to form a short oviduct, which opens to the exterior, slightly behind the anal opening. The ovaries in mature condition were light orange. Subsequent to spawning the superficial blood vessels supplying the ovaries become enlarged and conspicuous. The smallest mature male and female collected in the present study had a size of TL=14,

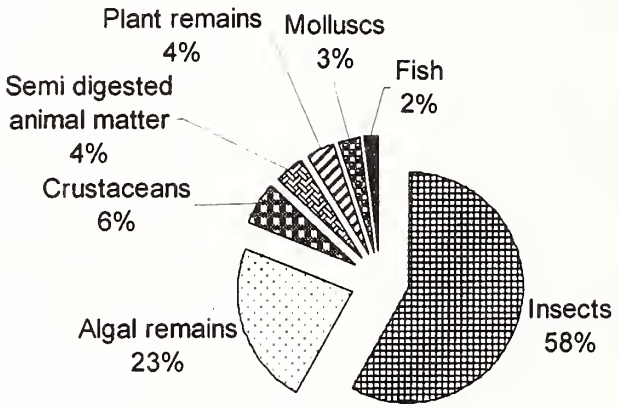

Fig. 2: Index of Preponderance of *Horabagrus nigricollaris*

Table 1: Coefficients of length-weight relationship and statistical analysis of *H. nigricollaris*

	Sample size (n)	Length range (cm)	Weight range (g)	'n'	log *a*	S.E.(b)	r	t	Sig.
Male	21	9.5-17.4	10-53.3	2.657	-1.610	0.092	0.989	28.980	0.000*
Female	23	9.4-18.7	8.4-66.95	2.934	-1.934	0.107	0.986	27.403	0.000*
Indeterminate	4	7.0-8.8	3.70-7.05	2.856	-1.846	0.382	0.983	7.481	0.032*
Combined	48	7.0-18.7	3.70-66.95	2.855	-1.839	0.046	0.994	62.167	0.000*

* = Significant at 5 % level.

TW=26.15 and TL=15.6, TW=33.70 respectively. Ripe males and females were collected only during January, February, November and December and hence it is concluded that the breeding season of the species is from November to February in this habitat. Most of the collected individuals had predominantly ripe ovaries from November-January. In February gravid fishes became less numerous. It can be inferred that the species is a total spawner and November-January is the spawning period of the species. The absolute fecundity of the ripe female of total length (TL) 15.6 cm and weight 33.70 g was 1,320 eggs, with a relative fecundity and GSI value of 39 eggs/g body weight and 9.5 respectively. The sex ratio of the male to female was 1:1.1. The mean ova diameter was 1.80 mm. The juveniles of the species were available from February onwards in the shallow stretches of the regime reaches during night and are easily vulnerable to simple fishing gears. Fingerlings (50-80 mm) have been collected by us from February to June in the vicinity of its microhabitat. The cyclic changes were studied in relation to different maturity stages. Qayyum and Qasim (1964a, b, c) and Bhatt (1971) were followed to observe the following maturity stages. The characters used for the classification of the ovary were appearance, colour, size, state of distension, relative space occupied in the body cavity, the size of the ova and their yolk content. In the case of testes, besides the general appearance, colour, size, etc., the extent of lobulation of the edges was used for determining the stage. Following maturity stages (Table 2) have been observed seasonally for *H. nigricollaris*.

DISCUSSION

The scrutiny of 'r' values showed very good correlation between length and weight. The exponent value '*n*' for males, females, indeterminate and combined class of *H. nigricollaris* in the present study was less than '3' indicating that increase in weight is relatively less compared to length. The growth in weight relative to length is allometric showing deviation from the 'cube law' (Le Cren 1951). From the above it may be seen that the value of '*n*' was higher in females, since the females have better condition and growth than the males. The value of exponent '*n*' for an ideal fish which maintains the same shape throughout its life cycle without any change, is equal to 3.0 (Allen 1938). According to Martin (1949), the value of exponent '*n*' in the parabolic equation usually lies within a range of 2.5-4.0. The change in exponent is due to changes in specific gravity and shape of the body contour and in such cases, the cube law need not always hold good. Morphological changes due to age also cause substantial changes in the exponent of length on weight. While discussing the merits of allometric growth formula, Beverton and Holt (1957) stated

Table 2: Gonadal condition of different maturity stage of male & female *H. nigricollaris*

No. of stages	Stages	Testis	Ovary
1	Immature	Very narrow, white, elongated, delicate and thread like testis. Left slightly longer than the right one.	Right and left ovaries more or less equal in length and size; colourless to whitish Eggs very minute, distinct only under microscope.
2	Maturing	More clear, pinkish white left lobe slightly longer than right. From each testis numerous finger like lobes arise.Occupies1/2 of the body cavity	Ovary considerably larger; yellowish white in colour; maturing eggs visible through wall under the microscope; left ovary longer than the right one.
3	Mature	Stages II & III cannot be distinguished clearly; both stages more or less similar the only difference is in the prominence of finger like lobes in the latter stage.	Reddish brown or yellow, shorter than fully mature ovary; differs from fully mature one in its colour (quite yellowish to orange in case of fully mature ovary)
4	Fully mature or Ripe	Testes become more elongated and extend over the entire visceral cavity. Creamy white in colour.	Yellowish to orange; ovaries visible through the translucent body wall of abdomen from outside; one or two ripe eggs remain in the oviduct. Mean ova diameter 1.8 mm.
5	Spent	Colour fades; testes seem to be dorsoventrally flattened. Occupy ½ to ¾th of the visceral cavity.	Colour fades; ovary elongated but shrunken and slightly wrinkled. A number of immature and a few mature yellow eggs still remaining in nearly empty bag; ovarian wall transparent.

that instances of important deviation from isometric growth in fishes are rare. In the present study, deviation from the isometric value of '3' was evident, and such deviations from the isometric value of '3' have also been reported in many fin fishes.

Insects were the dominant food item contributing 59% of the total gut content. The second major item is the algal remains contributing 23% followed by crustaceans, semi-digested animal matter, plant matter, molluscs, fish in the ratio of 5.8%, 3.7%, 3.6%, 2.7%, 2.2% respectively. In general, the gut contents of animal origin contributed the major share (73%) followed by material of plant origin (24%) and the rest by others. The dense overhanging vegetation of the forest habitat is an important allochthonous source of food particularly insects, fruits and larval forms of fish. In addition, the leaf litter supports large numbers of aquatic insects, gastropod molluscs and young fish. The occurrence of scales along with fish remains shows that the species often feeds on fish probably on dead or decaying fish. Sand and mud are accidentally taken while feeding on other food items particularly insects and crustaceans. The presence of sand and mud in the stomach also indicates the bottom feeding habit of the fish.

H. nigricollaris possesses a well-marked single group of oocytes and the breeding season is short and lasts for about four months. According to Qasim and Qayyum (1961) in fishes which possess single group of oocytes during the breeding season, the cycle of spawning in each individual occurs only once a year and the state of maturity at any given time is fairly uniform throughout the population. In the ovaries of fishes which spawn only once a year and in which the duration of spawning is restricted to a definite and short period, the mature stock of ova can be differentiated from the general egg stock; ovary has only one batch of mature eggs to be shed during the succeeding spawning season. Fecundity of any species of fish depends not only upon the size and age of the fish, but also on the size of the egg. The fish in which the eggs are larger, the fecundity will be lower when compared to fish with smaller eggs. According to Svardson (1949) larger larvae produced from larger eggs have a better chance in natural selection than smaller larvae produced from smaller eggs.

The length-weight relation clearly indicates that the Imperial White-collared Catfish follows allometric growth in its type locality in Chalakudy river. From the above observations it can be concluded that *H. nigricollaris* is a benthophagic omnivore showing preference towards animal diet. *H. nigricollaris* possesses a well-marked single group of oocytes and the breeding season is short and lasts for about four months (November to February). The conservation actions needed include judicious exploitation of the fish stocks, artificial propagation and regular ranching programmes and also enforcement and declaration of closed season during the breeding season. The protective measures include protection of riverine pools and crevices which act as the microhabitat of the species. Urgent attention to declare certain rocky pools and crevices as sanctuaries is essential as the species is on the verge of extinction.

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